v)attachment of signal molecule causes change inside cell
vi)cell surface membrane allows entry of some signal molecules

h) explain what is meant by passive transport (diffusion and facilitated diffusion including the role of membrane proteins), active transport, endocytosis and exocytosis.

Passive transport

- Diffusion - the net movement of molecules from a region of high concentration of that molecule to a region of lower concentration of that molecule, down a concentration gradient. This occurs due to the natural kinetic energy possessed by the molecules or ions, which makes them move about at random. Therefore, the molecules reach an equilibrium situation where they are evenly spread in a given volume. No extra energy is needed for this process.

Factor	Effect
Increase temperature	molecules have more energy - rate of diffusion increases
Increase concentration gradient	more molecules on one side of a membrane - higher concentration gradient - rate of diffusion increases
Stirring/moving	increases movement of molecules - increases rate of diffusion
Surface area	more area for molecules to diffuse across - rate of diffusion increases
Distance	greater distance for molecules to travel - rate of diffusion increases
Size of molecule	smaller molecules diffuse more quickly than larger ones

- Facilitated diffusion

i) facilitated diffusion using channel proteins - these basically form pores in the membranes, which are often shaped to allow only one type of ion through, they may also be gated.
ii) facilitated diffusion by carrier proteins - these are a specific shape so that only a specific molecule can fit into them at the membrane surface - when the correctly shaped molecule fits, the protein changes shape to allow the molecule through to the other side of the membrane.
iii) Different membranes have different carrier and channel proteins so they can have some control over the types of substances that are allowed in or out.

N.B. Fat-soluble molecules can simply pass through the bilayer. They diffuse down a concentration gradient.
Very small molecules and ions such as water, carbon dioxide and oxygen can pass through the membrane by going in between the phospholipid molecules.
It is only large or charged ions or molecules which need to take part in facilitated diffusion.

f) state that cells produced as a result of meiosis are not genetically identical (details of meiosis are not required).

Sexual reproduction involves the fusing of two cell nuclei which each contributes half of the total genetic information (genome) required by the offspring. Cells containing half the number of chromosomes must be produced, these are called gametes. Meiosis is a type of cell division which produces gametes and it takes place only in specific regions of the adult organism called the sex organs. This produces a cell with the haploid number of chromosomes (half the normal number) as opposed to the diploid number in cells other than gametes. Importantly;
i) meiosis produces cells containing half the number of chromosomes
ii) meiosis produces cells that are genetically different from each other, and from the parent cell.

g) define the term stem cell.

Stem cells are cells which have the capability to divide and develop into any of several different cell types. They are totipotent if the cells can divide into any of the types of cell found in the adult. They are pluripotent if the cells can develop into several different cell types.

h) define the term differentiation, with reference to the production of erythrocytes (red blood cells) and neutrophils derived from stem cells in bone marrow, and the production of xylem vessels and phloem sieve tubes from cambium.

Differentiation refers to the changes occurring in cells of a multicellular organism so that each different type of cell becomes specialised to perform a specific function. Cells can differentiate with changes to
i) the number of a particular organelle
ii) the shape of the cell
iii) some of the contents of the cell

All blood cells are produced from undifferentiated stem cells in the bone marrow.
Xylem and phloem come from dividing meristem cells such as cambium. Meristem cells undergo differentiation to form the different kinds of cells in the transport tissues.

i) describe and explain, with the aid of diagrams and photographs, how cells of multicellular organisms are specialised for particular functions, with reference to erythrocytes (red blood cells), neutrophils, epithelial cells, sperm cells, palisade cells, root hair cells and guard cells.

Erythrocytes;
i) lose nucleus
ii) lose mitochondria
iii) lose Golgi apparatus
iv) lose RER
v) packed full of haemoglobin
vi) become biconcave discs

Neutrophils;
i) many lysosomes